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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/686,914	10/14/2003	Erez Yahalomi		7454

7590 02/28/2005
Erez Yahalomi
Tarpad 8
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ISRAEL

EXAMINER

WILSON, SCOTT R

ART UNIT PAPER NUMBER

2826

DATE MAILED: 02/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/686,914

Applicant(s)

YAHALOMI, EREZ

Examiner

Scott R. Wilson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 December 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3, 6-8, 10, 13, 14, 16, 19-21, 24, 28 and 30-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 6-8, 10, 13, 14, 16, 19-21, 24, 28 and 30-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>12/23/04</u> . | 6) <input type="checkbox"/> Other: _____ |

Response to Amendment

Claim Rejections - 35 USC § 112

Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is not clear what applicant means by "the wave function size is referred to the uncertainty distribution in space of the particle wave function".

Claim 14 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is not clear what applicant means by "achieved by a potential energy interaction".

Claim 28 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The phrase "wherein the particle size is dependent" is unclear, since the particle size is either zero for an electron, or about the radius of a proton for neutrons and protons.

Claims 31-36 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The phrase "the particle is increased in size" is unclear, since the particle size is either zero for an electron, or about the radius of a proton for neutrons and protons.

Claims 1-3, 6-8, 10, 13-14, 16, 19-21, 24, 28, 30-41 are rejected as failing to define the invention in the manner required by 35 U.S.C. 112, second paragraph.

The claim(s) are narrative in form and replete with indefinite and functional or operational language. **The structure which goes to make up the device must be clearly and positively specified. The structure must be organized and correlated in such a manner as to present a complete operative device.** The claim(s) must be in one sentence form only. Note the format of the claims in the patent(s) cited.

Claim Rejections - 35 USC § 102

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Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Kane. Kane, Figures 1-3, discloses a switching device for switching between two states in computing on or off states, wherein the switched state depends on the particle wave function size in space and wherein the wave function size depends on the particle total energy and the switching between the two device states is done by changing the particle total energy. Kane discloses a quantum computer array in which the nuclear spin resonance frequency of ^{31}P is adjusted by a voltage applied to an "A-Gate". The electron wave function of the ^{31}P atom is pulled away from the nucleus, thereby reducing the hyperfine interaction, which depends on the value of the wave function evaluated at the nucleus. The smaller hyperfine matrix element reduces the nuclear resonance frequency. Kane further discloses an electron mediated nuclear spin interaction, in which an electron couples adjacent nuclear spins. Figure 3 illustrates that the electron coupling is controlled with a "J-Gate". It is this electron mediated nuclear spin interaction which flips nuclear spins, thereby switching between states in a two-state system, which is required for quantum computation. The switched state depends on the mediating electrons wave function size in space, as embodied in Figure 3. The electron wave function size in space is controlled by applying a voltage to the J-Gate, which adds energy to the system, and is within the scope of changing the electrons total energy.

As to claim 2, Kane, Figure 3, discloses that the wave function with $J>0$ is larger than the wave function with $J=0$, and since the J-Gate voltage is a continuous quantity, the wave function size is also a continuous quantity and may be adjusted to be larger or smaller.

As to claims 6 and 7, the mediating electron changes both its kinetic and potential energies, as its wave function increases in size with increasing J-Gate voltage.

As to claim 10, since the switching between the two states is an electromagnetic interaction, it is mediated by virtual photons.

As to claim 16, Kane, Figure 3, discloses two boundaries, which may be envisioned as a vertical boundary between the left-hand A-Gate and the J-Gate, and between the J-Gate and the right-hand A-Gate. The two switching states differ in the potential between the two boundaries, as shown in the Figure.

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As to claims 19 and 20, since the two states are defined by a voltage applied to the J-Gate, which is an electromagnetic interaction, it is mediated by the emission and absorption of virtual photons.

As to claim 21, the dynamic change of the spatial extent of the electron wave function as the J-Gate voltage increases to a given value is within the scope of being a charge current.

As to claim 24, Kane, discloses that the interactions of neighboring ^{31}P atoms are mediated by electrons.

As to claim 30, Kane, Figure 3, discloses that the change in state is detected by a corresponding change in voltage on an electrode, the J-Gate.

Claim 37 is rejected under 35 U.S.C. 102(b) as being anticipated by Kane. Kane, Figure 2, discloses a method of switching comprising providing an electron from a donor atom, embodied as ^{31}P , having a wave function bound to the region surrounding the atom, switching the electron from a first lower energy state, where $V=0$, with a first wave function size, to a higher energy state, where $V>0$, with a larger wave function size, and where the donor electron remains bound to the donor atom, and determining the electron state by measuring the A-Gate voltage.

As to claim 38, Kane, figure 2, discloses the measurement of the voltage on the A-Gate to determine the electron state.

As to claim 39, the dynamic change of the spatial extent of the electron wave function as the A-Gate voltage increases to a given value is within the scope of being a charge current.

As to claim 40, the electron wave function size in space is controlled by applying a voltage to the A-Gate, which adds energy to the system, and is within the scope of changing the electrons total energy.

As to claim 41, since the two states are defined by a voltage applied to the A-Gate, which is an electromagnetic interaction, it is mediated by the emission and absorption of virtual photons.

Claim Rejections - 35 USC § 103

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kane in view of Yahalomi (IDS reference number 2). Kane discloses the invention of claim 1, as described above. Kane does not

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expressly disclose an elastic or inelastic collision which changes the wave function size in space.

Yahalomi discloses (Abstract) that the wave function size may change due to the particle interaction with a detector. An elastic or inelastic collision is within the scope of being a detection, in the sense that it collapses the wave function of the incident particle. At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine the teachings of Kane with that of Yahalomi. The motivation would have been to offer an additional means of changing the wave function size in space. Therefore, it would have been obvious Kane with Yahalomi to obtain the invention as specified in claim 8.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kane in view of Beil et al.. Kane discloses the invention of claim 1, as described above. Kane does not expressly disclose phonon energy exchange to switch between two states. Beil et al. discloses (Abstract) a two state system which may switch states via phonon interaction. At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine the teachings of Kane with that of Beil et al.. The motivation would have been to offer an additional means of changing the wave function size in space. Therefore, it would have been obvious Kane with Beil et al. to obtain the invention as specified in claim 13.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The well-known finite square well disclosed in Weisbuch and Vinter is within the scope of being two regions which create a repulsive potential on a particle between them, wherein the size of the wave function depends on the depth of the well, V_0 . As the depth V_0 decreases, the tunneling length into regions $z < -L/2$ and $z > L/2$ increases, thus expanding the size of the wave function in the length dimension z .

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

This action is a **final rejection** and is intended to close the prosecution of this application. Applicant's reply under 37 CFR 1.113 to this action is limited either to an appeal to the Board of Patent Appeals and Interferences or to an amendment complying with the requirements set forth below.

If applicant should desire to appeal any rejection made by the examiner, a Notice of Appeal must be filed within the period for reply identifying the rejected claim or claims appealed. The Notice of Appeal must be accompanied by the required appeal fee of \$165.

If applicant should desire to file an amendment, entry of a proposed amendment after final rejection cannot be made as a matter of right unless it merely cancels claims or complies with a formal requirement made earlier. Amendments touching the merits of the application which otherwise might not be proper may be admitted upon a showing a good and sufficient reasons why they are necessary and why they were not presented earlier.

A reply under 37 CFR 1.113 to a final rejection must include the appeal from, or cancellation of, each rejected claim. The filing of an amendment after final rejection, whether or not it is entered, does not stop the running of the statutory period for reply to the final rejection unless the examiner holds the claims to be in condition for allowance. Accordingly, if a Notice of Appeal has not been filed properly within the period for reply, or any extension of this period obtained under either 37 CFR 1.136(a) or (b), the application will become abandoned.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott R. Wilson whose telephone number is 571-272-1925. The examiner can normally be reached on M-F 8:30 - 4:30 Eastern.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NATHAN J. FLYNN
SUPERVISORY PATENT EXAMINER
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Srw

2/16/05